IMAGING SYSTEM USING POLARIZATION EFFECTS TO ENHANCE IMAGE QUALITY

Abstract

The quality of images produced by confocal microscopy, and especially scanning laser confocal microscopy, is enhanced especially for images obtained in turbid mediums such as many biological tissue specimens, by reducing speckle from scatterers that exist outside (above and below) the focal plane region which is being imaged by utilizing sheared beams, both of which are focused to spots in the focal or image plane (region of interest) and polarizing the beams to have opposite senses of circular polarization (right and left handed circular polarization). The return light from the image plane of certain polarization is detected after passing through the confocal aperture of the confocal microscope. Light from scatterers outside the region of interest, which are illuminated by both of the sheared beams, interfere thereby reducing speckle due to such scatterers, and particularly scatters which are adjacent to the image plane. Sheared beams having orthogonal linear polarization, as may be obtained from a Wollaston or Nomarski prism are converted into circularly polarized beams of opposite polarization sense by a quarter wave plate. The optical signals representing reflections from the focal plane are derived by polarizing optics which may either, be a polarizing beamsplitter in the incident beam path or with a retarder and analyzer. The retarder may be selected to provide different polarization phase shift of the return light, and with the analyzer, detects the degree of elliptical polarization representing the optical activity and circular dichroism producing the optical signal representing the image.